

## APPENDIX C DIVING

### Section I. General

#### PURPOSE

a. Engineer divers support all diving missions in the theater of operations. Engineer support in the communication zone is provided on an area basis; and in the combat zone, it is provided on an individual task basis. Figure C-1 shows engineer diver deployment in the theater.

b. The Engineer Command (ENCOM) provides command and control to the theater army engineer force. Divers are assigned to the headquarters element of the ENCOM.

#### ENGINEER DIVING SUPPORT CONCEPTS

a. Engineer divers are deployed by the ENCOM based on mission priorities. Diver availability during mobilization is reduced because their numbers are limited in the theater. When diving assets are not used effectively, the ENCOM commander reassigns them to more critical mission sites.

b. Theater construction and repair missions that include divers are highly complex and require a management capability that spans interservice requirements and assets. To accomplish these missions, the theater commander sets construction priorities and policies. He also allocates construction assets and materials. The ENCOM commander applies these policies in assigning diving assets throughout the theater.

c. Combat Zone engineer diver tasks are usually in direct support of mobility operations. In the Communication Zone, the tasks usually center on sustainment operations, such as port construction, harbor clearance, salvage, and ship's husbandry. Divers also assist in interservice and immediate recovery operations.

d. The large mission requirements for engineer divers severely limits their availability during mobilization. Units are warned that divers are used mainly for Communication Zone construction and maintenance-oriented missions - not Combat Zone missions. Commanders with contingency plans that identify diver support requirements must consider the limited number of divers.

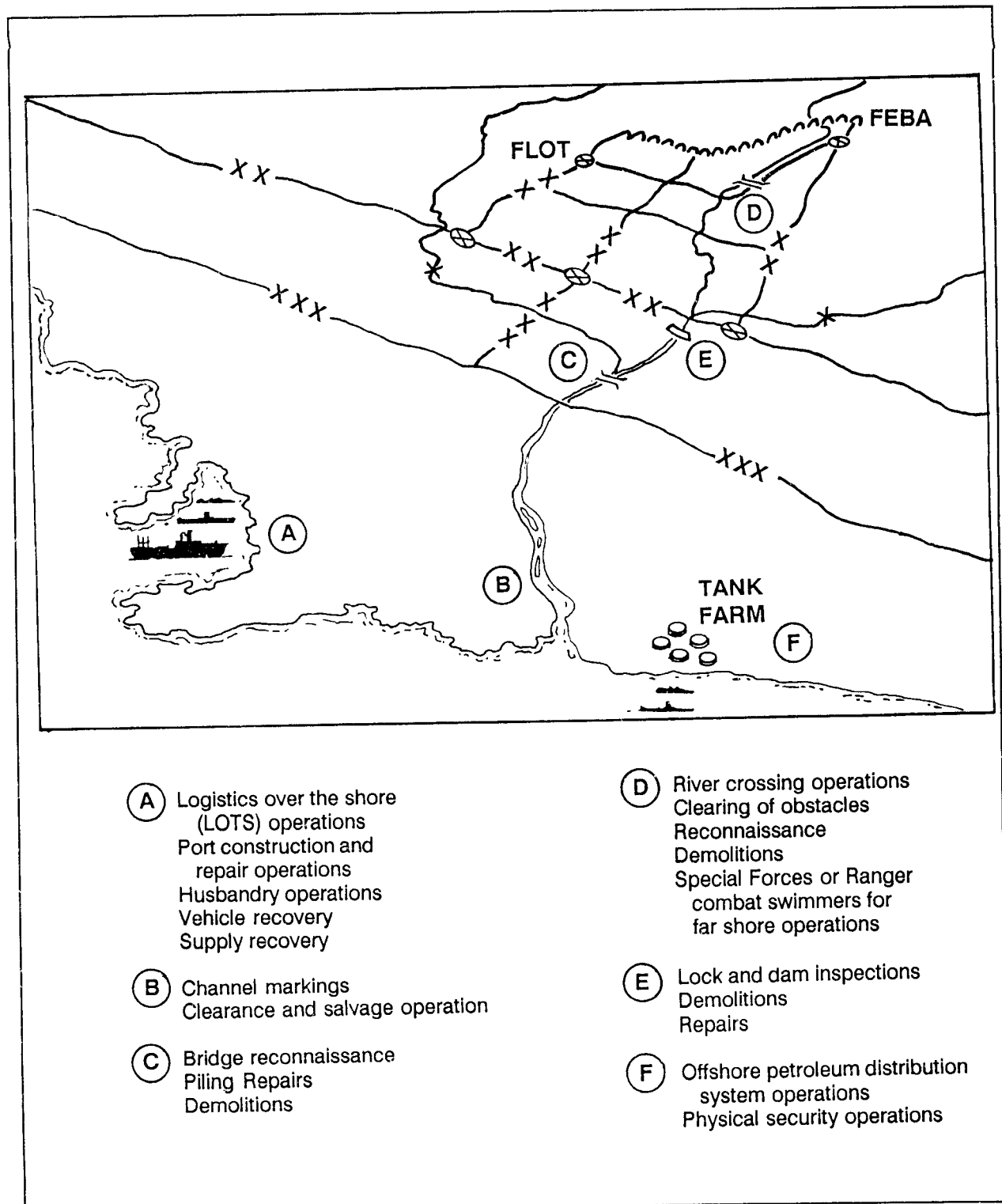


Figure C-1. Engineer Diver Deployment in the Theater

## DIVING SUPPORT REQUEST PROCEDURES

The ENCOM commander allocates diving assets in the Communication and Combat Zones according to priorities established by the theater commander. After completing mission analysis, the ENCOM commander assigns divers to the appropriate organizational level. Figure C-2 illustrates request channels for engineer divers.

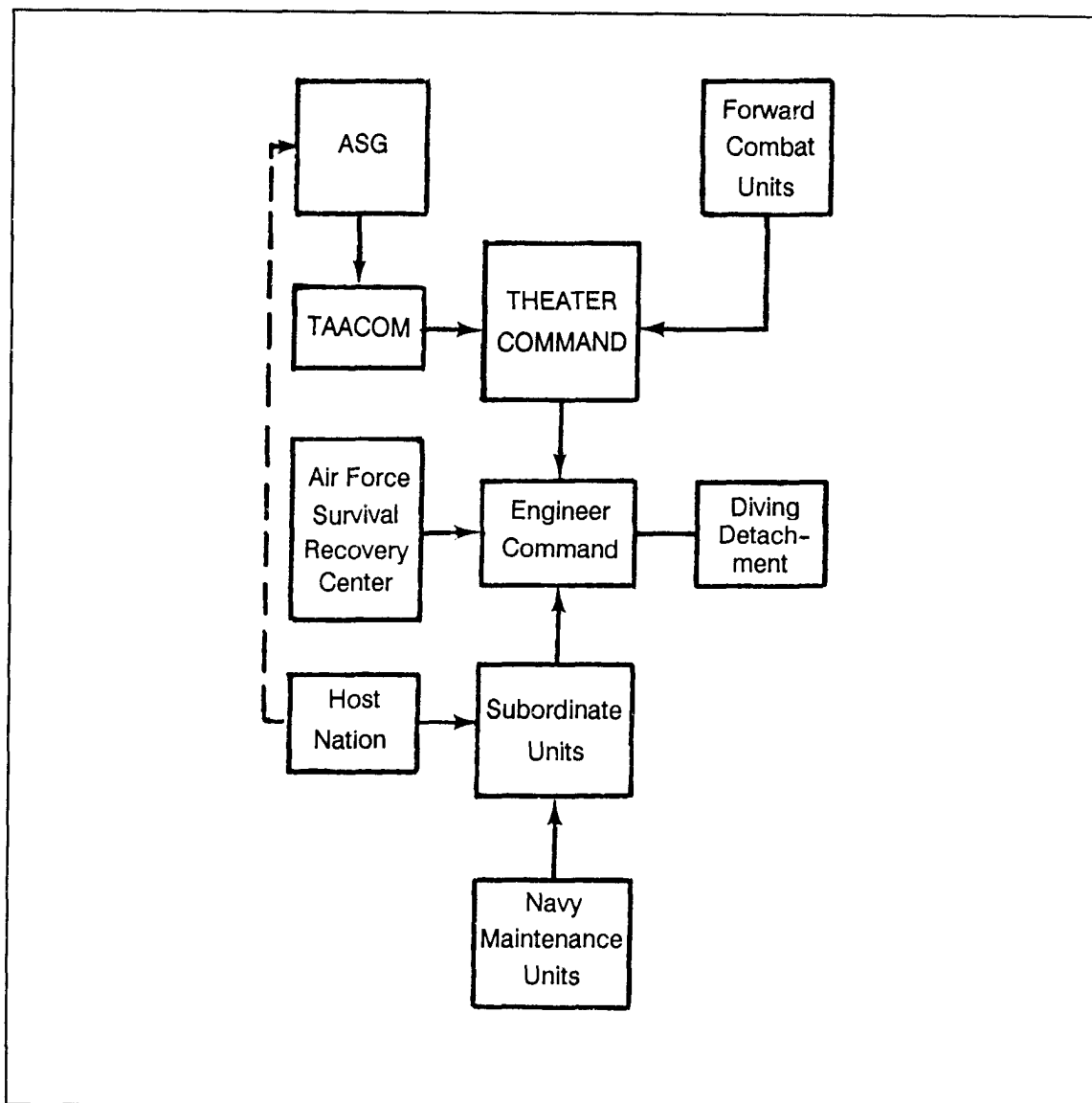


Figure C-2. Request Channels for Engineer Divers

## COMMUNICATION ZONE

a. If an area support group (ASG) needs diving assets for underwater missions, it requests the diving support through normal channels to the theater command. The request must include mission details and an estimated time requirement for completion. If the request is approved, the theater commander will task the ENCOM to support the mission, and the ENCOM commander will assign diving assets. For short-term missions, diving assets are assigned in direct support through command channels to the ASG. For long-term or complex missions, divers are attached to a company- or battalion-sized unit.

b. For example, if a port construction company of an ASG needs diving assets for port repair, the ENCOM commander will assign the assets in an attached command relationship through command channels to the construction company.

## Section II. Engineer Diving Force Organization

### GENERAL

The engineer diving force is a relatively small and specialized organization. Each section of the diving force has specific duties and responsibilities, but is flexible enough to improvise in supporting the theater as the situation changes. The diving force is divided into two major groups:

a. The control and support diving detachment (C&S) provides command, control, and support of diving missions.

b. The lightweight diving team (LW team) executes most of the work performed by divers.

### CONTROL AND SUPPORT DIVING TEAM

The C&S detachment provides command, control, liaison, and support functions for diving assets. Each C&S detachment supports as many as six LW teams. The C&S detachment has inspection and survey capabilities and provides the following specialized support to LW teams:

- a. Mission analysis for equipment requirements
- b. Training and diver requalification
- c. Special equipment and additional personnel to augment the LW section
- d. Diving equipment supply support and repair parts to the intermediate level
- e. Diving equipment intermediate level maintenance
- f. Recompression chamber treatment
- g. Specialized medical support

## LIGHT WEIGHT DIVING TEAM

a. The LW diving team is assigned to a C&S detachment and is dependent upon it for specialized support. The LW units are allocated based on mission requirements. The teams are usually attached to company-sized units if the mission requires extended diver support. The supported units usually are: engineer company, port construction; transportation company, floating craft, general maintenance; and quartermaster company, marine pipeline terminal.

b. Capabilities:

- \* The LW team has 17 soldiers and sufficient equipment resources to deploy either one surface-supplied diving team or two scuba sections.

- \* The LW team performs diving missions to 190 feet with a 2.5 knot (4.2 feet per second) water current. They perform scuba missions to a depth of 130 feet with 1 knot (1.7 feet per second) water current. The LW team cannot support 24-hour operations or work in conditions requiring total diver enclosure for protection. The usual work shift for the LW team is 12 hours. For 24-hour operations, the LW unit needs extra personnel, support, and equipment from the C&S detachment.

## Section III. Diving Missions

a. Engineer divers require time to move, set up, and begin operations. Once on site, a diving section may need up to two hours of preparation time. It is critical to include diving planners from the C&S detachment during the early planning stages of an operation to ensure successful diving missions.

b. Lightweight diving teams provide underwater construction support for the following operations:

- \* Port construction and repair
- \* Clearance and salvage (See Section IV)
- \* Ship's husbandry
- \* Physical security
- \* Logistics over the shore (LOTS)
- \* Offshore petroleum distribution systems
- \* River crossing
- \* Graves registration
- \* Pre-occupation activities
- \* Pre-occupation activities in support of port construction

c. Rehabilitation missions include:

- \* Initial underwater surveys to determine the possibility of restoring port facilities to operational status
- \* Inspection of damaged, sunken vessels or other obstructions in port to determine salvage or removal requirements
- \* Development of salvage plans for clearing the port area and ship's channels
- \* Development of a diving and salvage effort time analysis for port restoration
- \* Underwater damage assessment of existing pier facilities

d. The diving detachment commander provides a detailed report describing existing damage and recommendations for repair to the Army water terminal commander, the area engineer, and the port construction company commander. The report includes-

- \* Port restoration plans
- \* Sunken vessel location
- \* Ship's channel obstacles
- \* Vessel damage
- \* Vessel or obstacle removal techniques
- \* Underwater mines and munitions location

*NOTE: Engineer divers are not capable of explosive ordnance disposal (EOD) missions. The report must include a basic description of mines or munitions and their locations for later removal by qualified personnel.*

## OCCUPATION ACTIVITIES

Occupation activities are conducted to clear and repair ports and harbors. Divers provide hydrographic data and port charts to the Army water terminal commander, port construction units, and area engineer. Divers also provide ongoing quality assurance inspections of underwater construction activities. Occupation activities include:

- \* Port construction
- \* Port repair
- \* Clearance operations
- \* Salvage operations
- \* Underwater physical security
- \* Graves registration support

## **PORT CONSTRUCTION**

a. Building new ports and port facilities is a major undertaking that usually requires extensive diver support. Support requirements include the initial port site reconnaissance and selection. Divers perform a hydrographic survey of the proposed area to determine possible locations for ship channels, deep water mooring sites, and underwater obstacles.

b. Hydrographic surveys provide the port commander with a detailed chart of underwater port areas. The chart indicates the depth gradients, ship channels, and location and type of obstructions in the operational area.

c. Additional port construction operations include clearing obstacles or obstructions, vessel or equipment salvage, and installation of underwater security systems.

## **PHYSICAL SECURITY OPERATIONS**

a. Physical security operations include the development of active and passive security systems to protect or provide early warning of impending danger to ports, ship channels, or pier facilities.

b. Divers can assist in placing permanent physical security systems in port areas, on freed bridges, and in waterway lock and dam systems. Divers also perform pre-entry security swims for vessels moored outside the secured boundaries of a port, security system, or maintenance operation. The request for diving support must include the type of physical security system used.

c. Physical security systems are usually placed at harbor entrances, along the open areas of port facilities, and around bridge abutments. The systems are passive or active and are designed to stop or detect vessels, underwater swimmers, or floating mines. The systems usually require diving support to install and maintain them.

d. Passive security systems require introducing obstacles or barriers that restrict the approaches and entrance to a harbor. Barriers across a harbor's access channel usually require constant maintenance and repair by divers. Electronic security systems are designed to detect or deter attack by underwater swimmers. Divers place and secure underwater systems after qualified personnel assemble them on shore.

e. Security swims are another form of physical security. Divers can perform physical security swims on the underwater portion of any vessel moored outside the secured perimeter of a port facility.

## **PORT REPAIR**

a. The repair of existing port facilities includes piers, quays, wharfs, dry dock facilities, marine railway systems, and other port structures. The method used depends on the original construction material, type of repair material available, and degree of repair desired. To ensure timely procurement of needed materials, divers must make a detailed underwater reconnaissance and assist in developing the bill of materials for repair.

b. Divers perform underwater repair of bearing piles, fender systems, and dolphin systems. Timber structure repairs range from replacing wood components to inserting steel members and applying concrete protective jackets.

c. Concrete is used to repair many port structures. These repairs require divers to clean the area with specialized equipment. Tasks range from filling minor cracks to replacing supporting steel structures. Usually, divers must place underwater concrete forms as well as the actual concrete.

d. Steel is used to repair bearing piles, piers, and fender systems with rubber bumpers. Steel structure repair is complex and requires divers to:

- \* Clean the repair area using specialized equipment
- \* Repair minor cracks using underwater welding techniques
- \* Remove and replace a damaged component
- \* Place underwater concrete forms and concrete

## GRAVES REGISTRATION

Divers assist in the recovery of personnel drowned during water operations. Their support is limited to the underwater search and recovery of bodies and not the recovery of bodies found floating or along the shoreline.

## Section IV. Clearance and Salvage Operations

### GENERAL

a. Clearance and salvage operations include removing and recovering usable material from ports and navigable waterways to reopen them for operations. The operations include:

- \* Recovery of equipment and supplies
- \* Removal of small obstacles
- \* Salvage of small ships or aircraft

b. Diver support depends on:

- \* Amount and size of obstructing debris
- \* Number of diving teams available
- \* Additional equipment and vessel support needed. Early planning which includes divers is important to allocate assets successfully



## CLEARANCE OPERATIONS

a. The purpose of clearance operations is to neutralize all obstacles blocking the channels in the port, docking facilities, mooring sites, marine railways, dry dock facilities, and lock and dam structures. These are usually natural obstacles (underwater rock formations), battle debris, or enemy-emplaced objects designed to prevent timely use of the facility by occupying forces. Clearing of salvageable vessels is discussed in the Salvage Operations section, page C-8.

b. Various methods are used to remove obstructions within the port area. Methods include using lifting bags from a diving tool kit, demolition charges, cranes, and underwater cutting equipment. Additional lifting force can be obtained from various items commonly found in a port facility, such as empty 55-gallon drums.

c. The use of demolitions underwater is an efficient method for removing obstacles in the port area. Special precautions, however, are required in the employment of demolitions in an underwater environment. Use electric firing systems whenever possible. This firing system improves control of the detonation of the charge, thus increasing the diver's safety. Verify the safe distance requirements for equipment and personnel in the water. Charges detonated in close proximity to vessels or personnel in the water can cause substantial damage or injury.

d. Underwater cutting operations are often required to reduce obstacles to a manageable size prior to removal. Divers have specific equipment for performing underwater clearance operations. The equipment includes the following hydraulic power, electric power, and common hand tools:

- \* The hydraulic power package includes the tools necessary to cut, drill, and clean structural components during construction or clearing operations. It also contains flexible lifting bags.

- \* The electric cutting and welding package includes the equipment necessary to perform underwater cutting and welding operations.

- \* Common hand tools are used underwater if the powered sets are not available. Time needed to perform tasks underwater by hand greatly increases mission time due to the difficulty of working underwater.

e. The nature of unloading and transporting supplies at sea usually results in the loss of some supplies into the water. Divers can recover these supplies quickly, assuring continued support to fielded units.

## SALVAGE OPERATIONS

a. Major salvage operations usually include clearing and removing vessels blocking port channels, berthing and docking facilities, mooring sites, and lock and dam facilities. The ability of divers to clear these vessels depends on the type, size, and location of the damaged vessel, and the time available for the salvage effort. Methods of vessel salvage range from simple hole patching and dewatering to the complete dismantling of the vessel into sections for removal.

b. Vessels that are beached arresting on the bottom with the superstructure above the mean low watermark are salvaged by patching exterior holes and dewatering the hull. The vessels are then towed to another location for repair by qualified units.

c. Vessels which are sunk with the superstructure below the mean low water level require more extensive salvage operations. Divers must make the entire vessel watertight. The vessel is then lifted by dewatering, attaching underwater lifting devices, attaching lifting devices from surface cranes, or by a combination of these techniques.

d. Unsavable vessels are either left in place, sectioned and removed, or flattened with demolitions. Sectioning includes cutting the vessel into manageable pieces, then removing the pieces to designated locations. Flattening includes removing the superstructure and crushing the hull into the port bottom using demolitions.

## Section V. Logistics

### GENERAL

Engineer divers must have logistical support to perform their wartime missions. Commanders must understand the combat support and combat service support system and know where to request the correct logistical support to ensure successful diving missions. Diving support requirements sometimes are quite substantial, and limitations can totally change a carefully made plan.

### COMBAT SUPPORT

Divers depend on supported units for combat support and survivability needs, including:

- \* Enemy air attack suppression
- \* Enemy indirect fire suppression
- \* Scatterable and fixed mine clearing
- \* Underwater mine clearing
- \* Nuclear, biological, chemical (NBC) decontamination
- \* Ammunition
- \* Survivability position construction

### COMBAT SERVICE SUPPORT

a. Divers depend on supported units for most combat service support needs in the areas of:

- \* Maintenance

- \* Supply
- \* Administration

b. The C&S detachment provides diving teams with intermediate direct and general support maintenance on all life support systems and diving equipment. The C&S detachment and LW diving teams depend on supported units for all Class IX supplies (repair parts) and maintenance support above the operator level for ordnance equipment. Supported units, not serviced by a direct support company, order ordnance repair parts from the ASG maintenance battalion. Repair parts for diving life support systems and diving equipment are ordered by the C&S detachment directly from the ENCOM.

### **EQUIPMENT SUPPORT**

a. The supported unit commander has the ultimate responsibility to allocate local assets and assign local work priorities to divers. Equipment common to most diving missions includes:

- \* A floating work platform to provide surface-supplied diving capabilities away from the shoreline. The platform needs enough space to accommodate diving systems, support equipment, and required personnel.

- \* A crane to lift diving equipment onto the diving platform. It is also used to lift special equipment from the water for maintenance operations or to remove items during clearance and salvage operations.

- \* Generator and welder sets for underwater welding operations.

- \* An acetylene torch set for metal cutting and salvage operations. Divers cannot perform welding on aluminum alloys.

b. Some diving missions require special equipment and support from the units dedicated to the construction and repair of port facilities. The missions and special equipment include:

- \* Port construction and repair operations. The support requirements for divers are usually available from port construction companies. Special equipment includes concrete mixing machines, concrete pumps, pile drivers, piles, clamshell digging devices, and construction machinery.

- \* Clearance and salvage operations. Special equipment includes large winching devices or crawler tractors, such as D-7 dozers, to assist in pulling small craft or debris from ship channels. Extra work platforms and warping craft are sometimes needed.

- \* Physical security operations. The construction of physical security systems requires various types of support, depending on the type of security system installed. Special equipment includes watermarkers for underwater mines, electronic security devices, netting, and control craft.

c. The special equipment needed for support requirements usually takes extra time to procure or fabricate. Early planning and coordination help reduce logistics problems during diving missions.

## Section VI. Limitations

### ENVIRONMENTAL

a. Each type of diving has environmental limitations to consider when planning and conducting a diving operation. The C&S detachment should provide a survey team to study the work site and make recommendations regarding the use of divers. Factors such as water temperature, depths, currents, and environmental protection must be considered. The following table lists average underwater limitations.

b. If water speeds are in excess of the limits in the table, some alternatives are possible to rectify the problem. Moving the operation site to slower waters or constructing baffles to deflect the water are two examples. Sometimes cofferdams, piles, or jetties can be used to isolate a construction area to improve working conditions.

### OPERATIONAL

a. Divers do not have the capability to work in unsecured areas. The supported unit must provide all site security during diving operations, especially in the combat zone. If explosives or mines are found during a diving mission, divers only mark and report them for removal later by qualified EOD personnel.

b. During river crossing operations, divers should not be assigned lifesaving responsibilities because they are not trained or qualified as lifeguards. Divers can perform underwater recovery operations but not to the time limits needed for emergency rescue operations. Diving skills are not recognized as a substitute for lifesaving skills. Properly equipped soldiers who are qualified by the Red Cross or similar agencies should perform lifeguard duties.

*Table C-1. Diving Limitations*

Type	Normal Water Depth (ft)	Water Current (knots) (fps)	Duration Under Water* (min)	NBC Protection	Environmental Protection	Salt Water Temperature Minimum (F°)
Heavyweight	190	2.5	40	None	Maximum	32
Lightweight	190	4.2	40	None	Minimum	0
Scuba	130	2.5	10	None	None	0
		1.0				
		1.7				

\*Also limited by individual diver endurance.